WHAT IS CLAIMED IS:

1. A method for frequency tuning of a photonic oscillator comprising:

a) supplying an optical signal;

b) modulating the optical signal;

c) delaying the modulated optical signal;

d) converting the modulated optical signal to an electric signal after delaying the optical signal;

e) amplifying the electric signal;

f) wherein modulating the optical signal comprises using the electric signal after amplifying; and

g) adjusting a frequency of an output signal of the photonic oscillator by adjusting a bias voltage of a first amplifier amplifying the electric signal.

2. The method of Claim 1 wherein adjusting the frequency of the output signal further comprises using a frequency lock loop circuit.

3. The method of Claim 2 wherein delaying the modulated optical signal comprises passing a portion of the optical signal through a long loop delay path and a portion of the modulated optical signal through a short loop delay path.

4. The method of Claim 1 wherein delaying the modulated optical signal comprises passing a portion of the modulated optical signal through a long loop delay path and a portion of the modulated optical signal through a short loop delay path.

5. The method of Claim 4 further comprising:

a) selecting a tone from a multi-tone output signal;

b) dividing a frequency of the selected tone;

c) providing a low frequency reference signal; and

d) locking the frequency of the tone after dividing, to the low frequency reference signal by adjusting the bias voltage of the first amplifier.

6. The method of Claim 4 wherein adjusting the frequency of an output signal of the photonic oscillator further comprises adjusting at least one of (1) an electrical phase shifter in series with the first amplifier; (2) an optical fiber stretcher; or (3) a bias voltage of a second amplifier coupled in series with the first amplifier.

7. A method for frequency tuning of a photonic oscillator comprising:

a) providing an optical signal;

b) passing the optical signal through an optical delay path via a modulator;

c) producing an electrical signal from an output of the optical delay path;

d) amplifying the electrical signal using a first amplifier;

e) modulating the optical signal using the electrical signal from the first amplifier; and

f) adjusting a bias voltage of the first amplifier in response to an output signal of the photonic oscillator so as to adjust a frequency of the output signal.

8. The method of Claim 7 wherein adjusting the frequency of the output signal further comprises using a frequency lock loop circuit.

9. The method of Claim 8 wherein passing the optical signal

through the optical delay comprises passing a portion of the optical signal through a long loop delay path and a portion of the optical signal through a short loop delay path.

10. The method of Claim 9 wherein using the frequency lock loop circuit comprises:

a) selecting a tone from a multi-tone output signal;

b) dividing a frequency of the selected tone;

c) providing a low frequency reference signal; and

d) locking the frequency of the tone after dividing, to the low frequency reference signal by adjusting the bias voltage of the first amplifier.

11. The method of Claim 10 wherein adjusting the frequency of the output signal of the photonic oscillator further comprises adjusting at least one of: (1) an electrical phase shifter in series with the first amplifier; (2) an optical fiber stretcher; or (3) a bias voltage of a second amplifier coupled in series with the first amplifier.

12. The method of Claim 7 wherein passing the optical signal through an optical delay comprises passing a portion of the optical signal through a long lop delay path and a portion of the optical signal through a short loop delay path.

13. The method of Claim 12 further comprising:

a) selecting a tone from a multi-tone electrical output signal;

b) dividing a frequency of the selected tone;

c) providing a fixed low frequency signal; and

d) locking the divided frequency of the selected tone with the fixed low frequency signal by adjusting the bias voltage

of the first amplifier.

14. The method of Claim 12 wherein adjusting the frequency of an output signal of the photonic oscillator further comprises adjusting at least one of (1) an electrical phase shifter in series with the first amplifier; (2) an optical fiber stretcher; or (3) a bias voltage of a second amplifier coupled in series with the first amplifier.

15. A photonic oscillator comprising:

a) a light source;

b) an optical modulator coupled to the light source;

c) at least one lightwave delay path coupled to the optical modulator;

d) at least one photodetector coupled to the at least one lightwave delay path;

e) a first amplifier coupled between the photodetector and the optical modulator;

f) a bandpass filter coupled between the first amplifier and the optical modulator; and

g) a control circuit coupled to the first amplifier constructed so as to be capable of adjusting a bias power to the first amplifier to shift a frequency of an output of the photonic oscillator.

16. The photonic oscillator of Claim 15 wherein the at least one lightwave delay path comprises:

a) a short loop lightwave delay path; and

b) a long loop lightwave delay path coupled in parallel with the short loop lightwave delay path.

17. The photonic oscillator of Claim 16 comprising:

a) an optical splitter coupling the long and short loop lightwave delay paths to the optical modulator;

b) a photodetector coupled to each of the long and short loop lightwave delay paths; and

c) a coupler coupling the photodetectors of the long and short loop lightwave delay paths to the first amplifier.

18. The photonic oscillator of Claim 16 further comprising a fiber stretcher located along at least one of: (a) the short loop lightwave delay path, or (b) the long loop lightwave delay path.

19. The photonic oscillator of Claim 18 comprising a fiber stretcher in each of the short loop lightwave delay path and the long loop lightwave delay path.

20. The photonic oscillator of Claim 19 further comprising a phase shifter coupled between the first amplifier and the bandpass filter.

21. The photonic oscillator of Claim 16 wherein the control circuit comprises a frequency lock loop circuit.

22. The photonic oscillator of Claim 21 wherein the frequency lock loop circuit comprises:

a) a narrowband filter coupled to the photonic oscillator so as to be capable of filtering a multi-tone electrical signal to provide a single tone electrical signal;

b) a frequency divider coupled to the narrowband filter;

c) a precision low frequency oscillator; and

d) a mixer coupled to receive signals from the

frequency divider and the precision oscillator so as to provide a mixed output signal capable of use in adjusting the bias power to the first amplifier.

23. The photonic oscillator of Claim 21 further comprising a coupler located between the first amplifier and the optical modulator, and wherein the frequency lock loop comprises:

a) a narrowband filter coupled to the coupler;

b) a frequency lock loop amplifier coupled to the narrow band filter;

c) a frequency divider coupled to the frequency lock loop amplifier;

d) a mixer coupled to receive signals from the frequency divider and a low frequency precision oscillator, the mixer being coupled to the control circuit so as to provide a mixed output signal to the control circuit; and

e) the control circuit being responsive to the mixed output signal to control the bias voltage of the first amplifier.

24. The photonic oscillator of Claim 23 further comprising a phase shifter coupled between the first amplifier and the bandpass filter, and wherein the control circuit is constructed to control the phase shifter in response to the mixed output signal.

25. The photonic oscillator of Claim 23 further comprising a fiber stretcher located along at least one of: (a) the short loop lightwave delay path, or (b) the long loop lightwave delay path, and wherein the control circuit is constructed to control the fiber stretcher in response to the mixed output signal.

26. The photonic oscillator of Claim 25 comprising a fiber stretcher in each of the short loop lightwave delay path and the long loop lightwave delay path, and wherein the control circuit is constructed to control each fiber stretcher in response to the mixed output signal.

27. The photonic oscillator of Claim 15 wherein the control circuit comprises a phase lock loop circuit.

28. The photonic oscillator of Claim 15 further comprising a second amplifier coupled between the photodetector and the optical modulator.

29. The photonic oscillator of Claim 15 further comprising a phase shifter coupled between the first amplifier and the bandpass filter.

30. A photonic oscillator comprising:

a) a laser;

b) an optical modulator coupled to the laser;

c) a lightwave delay path coupled to the optical modulator comprising:

(i) a short loop lightwave delay path; and

(ii) a long loop lightwave delay path coupled in parallel with the short loop lightwave delay path;

d) a first amplifier coupled between the photodetector and the optical modulator;

e) a bandpass filter coupled between the first amplifier and the optical modulator;

f) a bandpass filter coupled between the first amplifier and the optical modulator; and

g) a means for shifting a frequency of an output of the

photonic oscillator comprising a bias power adjusting means allowing adjustment of the bias power to the first amplifier.

31. The photonic oscillator of Claim 30 wherein the means for shifting the frequency of the output of the photonic oscillator comprises a frequency lock loop circuit.

32. The photonic oscillator of Claim 31 further comprising a fiber stretcher located in each of the short loop lightwave delay path and the long loop lightwave delay path, the fiber stretcher of each of the short loop delay path and the long loop delay path being capable of shifting the frequency of the output of the photonic oscillator in response to the frequency lock loop circuit.

33. The photonic oscillator of Claim 31 further comprising a phase shifter coupled between the first amplifier and the bandpass filter, the phase shifter being responsive to the frequency lock loop circuit.

34. The photonic oscillator of Claim 31 further comprising:

a)an optical splitter coupling the long and short loop lightwave delay paths to the optical modulator;

b)a photodetector coupled to each of the long and short loop lightwave delay paths; and

c)a coupler coupling the photodetectors of the long and short loop lightwave delay paths to the first amplifier.

35. The photonic oscillator of Claim 31 wherein the frequency lock loop circuit comprises:

a) a narrowband filter coupled to the photonic oscillator so as to be capable of filtering a multi-tone

electrical signal to provide a single tone electrical signal;

b) a frequency divider coupled to the narrowband filter;

c) a precision low frequency oscillator; and

d) a mixer coupled to receive signals from the frequency divider and the precision oscillator so as to provide a mixed output signal capable of use in adjusting the bias power to the first amplifier.

36. A photonic oscillator comprising:

a) a laser;

b) an optical modulator coupled to the laser;

c) a lightwave delay path coupled to the optical modulator comprising:

(i) a short loop lightwave delay path;

(ii) a long loop lightwave delay path coupled in parallel with the short loop lightwave delay path;

(iii) an optical splitter coupling the long and short loop lightwave delay paths to the optical modulator;

(iv) a photodetector coupled to each of the long and short loop lightwave delay paths;

(v) a coupler coupling the photodetectors of the long and short loop lightwave delay paths to the first amplifier; and

(vi) a fiber stretcher in each of the short loop lightwave delay path and the long loop lightwave delay path;

d) a first amplifier coupled between the photodetector and the optical modulator;

e) a phase shifter coupled between the first amplifier and the bandpass filter;

f) a bandpass filter coupled between the first amplifier and the optical modulator; and

g) a control circuit capable of adjusting a bias power to the first amplifier so as to shift a frequency of an output of the photonic oscillator, the control circuit being responsive to a frequency lock loop circuit.

37. The photonic oscillator of Claim 36 wherein the frequency lock loop circuit comprises:

a) a narrowband filter coupled to the photonic oscillator so as to be capable of filtering a multi-tone electrical signal to provide a single tone electrical signal;

b) a frequency divider coupled to the narrowband filter;

c) a precision low frequency oscillator; and

d) a mixer coupled to receive signals from the frequency divider and the precision oscillator so as to provide a mixed output signal capable of use in adjusting the bias power to the first amplifier.

38. The photonic oscillator of Claim 37 wherein the control circuit is constructed to control the phase shifter in response to the mixed output signal, and wherein the control circuit is constructed to control the phase shifter in response to the mixed output signal.